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**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, D. C. 20554**

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| In the Matter of | ) | |
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| Federal-State Joint Board on Universal Service | ) | CC Docket 96-45 |
| | ) | |
| Forward-Looking Mechanism for High Cost Support for Non-Rural LECs | ) | CC Docket 97-160 |

# COMMENTS OF BELLSOUTH CORPORATION, BELLSOUTH TELECOMMUNICATIONS, INC., U S WEST, INC., AND SPRINT LOCAL TELEPHONE COMPANIES IN RESPONSE TO PUBLIC NOTICE REQUESTING COMMENTS ON THE HYBRID COST PROXY MODEL


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BellSouth, US West and the Sprint Local Telephone Companies, the Joint Sponsors of the BCPM model (hereinafter "BCPM Sponsors") respectfully submit their Comments on the Hybrid Cost Proxy Model as requested in the Public Notice released October 31, 1997.

As set forth in the Public Notice, Commission staff members have developed an engineering process mechanism that is called the Hybrid Cost Proxy Model (HCPM). The HPCM presents an alternative means of addressing customer location and outside plant design issues. In the Public Notice, the Commission solicits comments regarding the model's customer location and loop design models. The comments presented here are largely based on the documentation provided by the HCPM sponsors at the FCC web site.[1] With very limited opportunity to review the HCPM, the ensuing comments reflect the BCPM sponsors' best understanding of the HCPM. Any statements that do not accurately characterize the HCPM are unintended.

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[1] *See* "The Hybrid Cost Proxy Model: Customer Location and Loop Design Modules" by C.A. Bush, D.M. Kennet, J. Prisbrey and W.W. Sharkey, Federal Communications Commission and Vaikunth Gupta, Panum Telecom, L.L.C.

# I. OVERVIEW OF HCPM AND SUMMARY

This analysis of the HCPM addresses the issues of customer location, outside plant and model flow. The BCPM sponsors and developers maintain that the enhanced Benchmark Cost Proxy Model (BCPM) provides greater precision in locating customers than HCPM. This important distinction between the two models stems from two very different approaches for utilizing housing and business line data at the Census Block (CB) level. HCPM uses microgrids that are sized based on the average size of the CBs contained within an ultimate grid and distributes customers uniformly within those microgrids. This is particularly problematic in those areas where precision is most needed, high cost areas where the CBs tend to be relatively large. In contrast, BCPM assigns customers within a CB to microgrids comprising that CB, based on the proportion of roads contained within each microgrid. The enhanced BCPM's use of road network data facilitates a more accurate identification of clusters of customers in high cost areas.

The enhanced BCPM's wire center boundaries are substantially more accurate than those used in HCPM. Accurate wire center boundaries are essential in assigning customers to their actual wire center and Local Exchange Carrier (LEC) so that subsidies are targeted appropriately.

Although the HCPM developers characterize the HCPM as an "optimization" model, it is more accurately described as a model that minimizes cost with respect to a prespecified, narrow range of technological alternatives. Using HCPM's characterization of a model that optimizes, the enhanced BCPM can be described as an "optimization" model as well. Moreover, HCPM neglects to consider the impact of significant constraints on their specification of technological alternatives, such as the impact of degradation in the signal on the ability to support advanced services.

The BCPM sponsors' analysis of the flow of the HCPM identifies a number of deficiencies in the model flow. Those deficiencies include using a "black box" method for performing calculations. All calculations are performed in Turbo Pascal and are not viewable or editable by the user. Ironically, one of the primary reasons why cost proxy models, such as the enhanced BCPM, are written in Excel is to address regulators' strong preference to use spreadsheets to mitigate this potential for a "black box."

In addition, HCPM is not user friendly. Editing the files is difficult, and without a user interface, there is greater potential for entry errors.

Contrary to the HCPM developers' claims, the BCPM sponsors' analysis indicates that it would be extremely difficult to integrate either the HCPM customer location module or the HCPM loop design module with modules from the enhanced BCPM or any other cost proxy model currently under consideration for funding universal service.

Finally, the HCPM does not comply with the FCC's ten criteria. Currently, HCPM does not include the costs of switching, transport, and signaling associated with providing basic service. It appears that HCPM is still in the early stages of development, and as such, requires substantial work before it can be considered as a tool for funding universal service.

## II. CUSTOMER LOCATION

While HCPM utilizes Census data at the CB level as BCPM does, the BCPM sponsors disagree with the HCPM sponsors' claim that the HCPM "customer location module determines the geographic locations of telephone subscribers to the finest resolution that is possible using currently available public data sources."[2] The BCPM sponsors maintain that the BCPM's

2 *Ibid.*, p. 1.

customer location module uses housing and business line data at the CB level in a manner that more precisely locates customers as described below.

To facilitate comparison of the two models without compromising accuracy in exposition, HCPM is described in terms comparable to those used to describe BCPM. HCPM's customer location module first constructs macrogrids.[3] These macrogrids are repeatedly cut into quarters until either "the maximum population criterion is met, or it is determined that only one Census block remains in the grid (and no further divisions are possible)."[4] (The resulting smaller grids are tantamount to "ultimate grids".[5]) Consequently, if there is only one CB in the ultimate grid and the population criterion is not met, the ultimate grid encompasses the entire CB. This is likely to occur in sparsely populated areas. HCPM subsequently creates micrograids within each ultimate grid, whose size is equal to the average area of CBs contained within the ultimate grid.[6] Each microgrid cell contains information about housing and business line demand. HCPM places customers uniformly throughout the non-empty microgrids.[7] This approach is particularly problematic in rural areas where CBs tend to be large in size because it is unlikely that customers are dispersed uniformly throughout the CB in all sparsely populated areas.

Furthermore, since the size of the microgrid to which this line information is assigned is equal to the average area of CBs within the ultimate grid, this approach adds very little precision

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[3] These macrogrids may be 18,000 feet by 18,000 feet or larger, according to the HCPM developers, *Ibid.*, p. 2.

[4] *Ibid.*, p. 4.

[5] The HCPM, "ultimate grids," conform to engineering guidelines specified by the HCPM developers, *Ibid.*, p. 5.

[6] *Ibid.*, p. 5.

[7] *Ibid.*, p. 1.

in assigning customer information below the CB level. Again, this is particularly problematic in rural areas where CBs tend to be much larger than those in urban areas.

BCPM, on the other hand, more precisely locates customers by taking the housing and business line information at the CB level and assigning that information at the microgrid level based on the proportion of roads that traverse that microgrid, relative to the microgrid area encompassed by a CB.[8] Since customers tend to live along roads, and rights of way for building a telecommunications network tend to exist along roads, the BCPM approach more accurately places customers than the HCPM approach which uniformly assigns customers throughout microgrids, especially when the area of the microgrid is relatively large, as it would tend to be in high cost areas.

Furthermore, the HCPM developers acknowledge that their customer location algorithm is deficient in dealing with large census blocks that exceed the area of a standard macrogrid. In such cases, HCPM currently assigns all housing and business line data to only one microgrid cell contained within the ultimate grid.[9] Thus, the HCPM grossly exaggerates the clustering of customers within such large census blocks by clustering all customers within only one microgrid cell. This approach substantially underestimates the cost of providing basic service to perhaps some of the very highest cost customers to serve.

The HCPM developers acknowledge another deficiency in the customer location module. They note that, "A second problem that may occur in both low and medium density areas is the issue of isolated cells within a grid."[10] The solution offered by the HCPM developers is to

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8 Microgrids in BCPM are approximately 1,500 feet by 1,700 feet, latitude and longitude.

9 *Ibid.*, p. 6.

10 *Ibid.*, p. 6.

reassign the microgrid to the nearest neighbor, if the cost is lower than serving that isolated microgrid.[11] However, this solution is potentially problematic when the ultimate grid is equal to the size of the macrogrid, which may be modeled as 18,000 feet by 18,000 feet in size. In such cases, the least cost solution of copper loop from the Digital Loop Carrier (DLC) to the customer cannot be utilized without incurring substantial costs, such as additional repeaters and an extended range line card that is approximately twice the cost of a standard POTS line card. This is why the BCPM developers limited the size of a macrogrid to 12,000 feet by 14,000 feet, latitude and longitude. This permits the BCPM customer location module to combine isolated cells within a grid with an adjacent ultimate grid without exceeding the 18,000-foot constraint on copper loop lengths.

In addition, HCPM uses data from On Target Mapping to establish wire center boundaries.[12] Although previous versions of BCPM used On Target Mapping data for wire center boundaries, the enhanced BCPM no longer uses On Target Mapping data. Instead, BCPM uses wire center boundary data obtained from Business Location Research (BLR). BLR provides substantially more accurate wire center boundaries than On Target Mapping. The HCPM documentation provides average investment per line for Gunnison, Colorado.[13] These results are unreliable because the wire center boundaries for Gunnison based on On Target Mapping data are grossly inaccurate.[14] (See Attachment 1 for a comparison of wire center boundaries for

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11 *Ibid.*, p. 6.

12 *Ibid.*, p. 23.

13 *Ibid.*, p. 24.

14 This is based on a comparison of wire center boundaries for Gunnison using On Target Mapping with boundaries based on BLR data.

Gunnison, CO using On Target Mapping data (used in BCPM 1.1) and BLR data (used in BCPM 2.0, 2.5 and 3.0).

It also appears that HCPM builds to households rather than housing units which include both occupied households and unoccupied households. Since providing facilities to unoccupied households is an important aspect of achieving the obligation to serve in a timely fashion, HCPM underestimates the cost of building a network that can provide universal service. The enhanced BCPM takes into account all housing units when constructing facilities.

## III. OUTSIDE PLANT

The HCPM developers maintain that HCPM is an "optimization" model. "Optimization" traditionally refers to maximizing or minimizing some function with respect to a specified variable(s) across a broad range of possible solutions. HCPM optimizes only in the sense that it attempts to minimize the cost of building a network by specifying, *a priori*, a narrow range of alternative approaches for designing outside plant. Moreover, the criteria used in HCPM for deploying the three specified alternative technologies, (*i.e.*, copper cable, fiber, and T1 copper),[15] do not adequately account for differences in the quality of transmission standard, the speed of transmission, the degradation of the signal, and the ability to support advanced services across these three technologies.

Applying the same characterization of "optimization" that the HCPM developers use to BCPM, one can describe the enhanced BCPM as an "optimization" model as well. For example, in the enhanced BCPM, main feeder beyond 10,000 feet from the wire center may be split and directed toward population clusters or it may run directly north, south, east, and west from the

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[15] *Ibid.*, p. 8.

wire center. The alternative selected minimizes the total route length. The enhanced BCPM also optimizes with respect to the number of Feeder Distribution Interfaces (FDIs) placed. The FDI may be co-located with the DLC to serve the distribution areas within a Carrier Serving Area; FDIs may be shared between the two distribution quadrants located to the left of the DLC and the two distribution quadrants located to the right of the DLC; or an FDI may be placed in each non-empty distribution quadrant. The placement of the FDI(s) is determined based on the cost minimizing alternative.

Furthermore, the BCPM developers contend that HCPM neglects to account for important constraints on the optimization process. One important constraint that is not adequately reflected in HCPM is the restriction that rights of way place on the routing of loop facilities. On the other hand, by taking into account the road network in placing customers, the enhanced BCPM reflects the fact that customers are likely to reside by roads and rights of way are likely to exist near roads. As alluded to earlier, HCPM also neglects important constraints on service quality with respect to dB/electrical loss when specifying alternative designs for outside plant. The following details constraints on loop technology that affect the ability of the network constructed by HCPM to provide the required capabilities as outlined in the Federal Telecommunications Act of 1996.

The use of 18,000 foot-two gauge copper design is within the limits of transmission for feeder and distribution if the entire loop is served from a wire center, and then only if Plain Old Telephone Service (POTS) is the only service provisioned for. The standard loss regarded as acceptable for good quality service is 8 dB. A 3,000-foot loop of 26 gauge (approximately 1.6 dB at .54 dB/kft) and 15,000 feet of 24 gauge (approximately 6.65 dB at .44dB/kft) falls within the standard. Other services have different standards. For example, PBX trunks and DID services have a maximum loss of approximately 5.5 dB, while WATS, Centrex, and Foreign Exchange have loss limits of 7dB. Following extensive testing of Fax/Modems, Pacific Bell's Pasadena Labs found that a maximum of 6 dB loss is all that is permissible to ensure that a 28.8 modem connects at that rate 60 to 80% of the time. Assuming 6 dB as a maximum loss to ensure all voice grade service and that 28.8 modems meet acceptable loss limits, requires drastic reductions in loop lengths. For example, to stay within 6 dB from a wire center, the loop could consist of 11.1 kft of 26 gauge or 13.6 kft of 24 gauge. It follows that 18,000 feet of loop length limits services to just POTS.

Loop lengths beyond a DLC vary depending on gauge and the type of channel unit plug-ins used. Using standard plug-ins (*i.e.*, Litespan RPOTS) which have 2dB inherent in the plug-in, the loop loss limit for POTS is 6dB or 13.6kft on 24 gauge and 11.1kft on 26 gauge. To extend these distances, very expensive range plug-ins (*i.e.*, Litespan REUVG) which are twice the cost of RPOTS, are required to eliminate the 2dB loss inherent in standard plug-ins. These extended range plug-ins extend 26 gauge to 14.8 kft and 24 gauge to 18kft. This is for POTS only.

In addition, it appears that HCPM neglects to include other costs associated with the technologies that HCPM deploys. From discussions at the FCC workshops, it appears that HCPM deploys HDSL technology. If this is indeed the case, HCPM does not include the cost of channel banks required for HDSL plug-ins. If instead, HCPM uses T1, then HCPM does not include the cost of repeaters required for provisioning basic service over T1s.

Finally, it should be noted that there are substantial differences in the total investment reported by HCPM and BCPM for each of the six wire centers examined during the FCC workshops. For example, the enhanced BCPM estimates a total investment for Vernon, TX of $2,238 while HCPM reports a total investment of $1,105. Despite the fact that BCPM includes the costs of switching and transport, these costs, which constitute a small fraction of the cost of providing basic service, cannot explain the wide disparity in total investment between the two models.

## IV. CRITIQUE OF THE MODEL FLOW

This overview focuses on the technical issues of HCPM, not the logic that the model is based on. It is important to differentiate between the logic, and the way the logic is implemented and delivered. In this case, implementation and delivery is accomplished using programs written in Turbo Pascal. This overview covers the various aspects of these programs.

There are two main modules to the HCPM - CENBLOCK.EXE and FEEDDIST.EXE. They are both command line executables that prompt the user for a wire center name. An option is available to pass the wire center name as a command line parameter when executing the program. The programs are run for a single wire center at a time. To run multiple wire centers through either program, a DOS batch file must be manually created with an entry for each wire center. (The documentation states that this option is currently only available on Windows NT systems.) Total state batch files are distributed with the model, but there is no mechanism to generate a run for a specific company within a state, for a company across multiple states, or other such scenarios. It is up to the user to manually add the proper wire centers to the batch file.

Data for each wire center is stored in separate files. This places an extra burden on the user to manage and maintain thousands of individual data files. The CENBLOCK program creates binary files that are unreadable by the user. The FEEDDIST program requires these files, making the CENBLOCK program a mandatory preprocessor to the FEEDDIST program. Although one of the design objectives of the HCPM is to have the two modules be able to work independently, in their current forms the two programs cannot be run without each other. Any other system utilizing the data from CENBLOCK would have to be able to decode the Pascal record structure used in the output files. Conversely, any other system developed to feed the FEEDDIST program would have to be able to replicate the Pascal record structure when writing the input files.

The support data exists in 15 external text files. While the content of the files is described in the documentation, editing them can be somewhat difficult. The files are in a format that is easily read by the system, but not easily read by users. Without a mechanism that provides a clear interface to the data, data entry errors will undoubtedly be made. While the accuracy of the data is ultimately the user's responsibility, providing a means to easily identify and modify the data would be a benefit.

The HCPM uses the "black box" method of performing calculations. All calculations are performed in the programming code and are not viewable or editable by the user. This means that adding or changing a calculation requires programmer intervention. Also, this prohibits the user or other interested parties from auditing or tracing through the calculations. There is no way to see intermediate results. Add to this the complexity of the calculations and the variability of the data, and testing the model becomes even more difficult. The burden of testing is placed primarily on the programmers since users don't see anything but the end result.

Currently there are no reporting options available in HCPM. Each program writes text to the screen as the program is processing, but there are no printable reports.

The two programs are written as standalone programs. There are no program interfaces, or ways for other systems to interface directly with the programs. The only way to integrate one of these programs into another system is for the other system to execute the program with the DOS command, and then read in the output files created. They are not modular in the sense that they can easily be plugged into one of the other cost models.

The limitations to the implementation and delivery of the HCPM handicap any benefit derived from utilizing the logic that the system is based on. The programming techniques utilized in the HCPM can be replicated in a system that uses Visual Basic and Excel while providing the user with all the benefits associated from using such a system. Features such as a user-friendly front end, multiple processing options, user access to calculations and intermediate results, multiple reporting options, and easier database maintenance would be of great benefit to end users.

Respectfully submitted,


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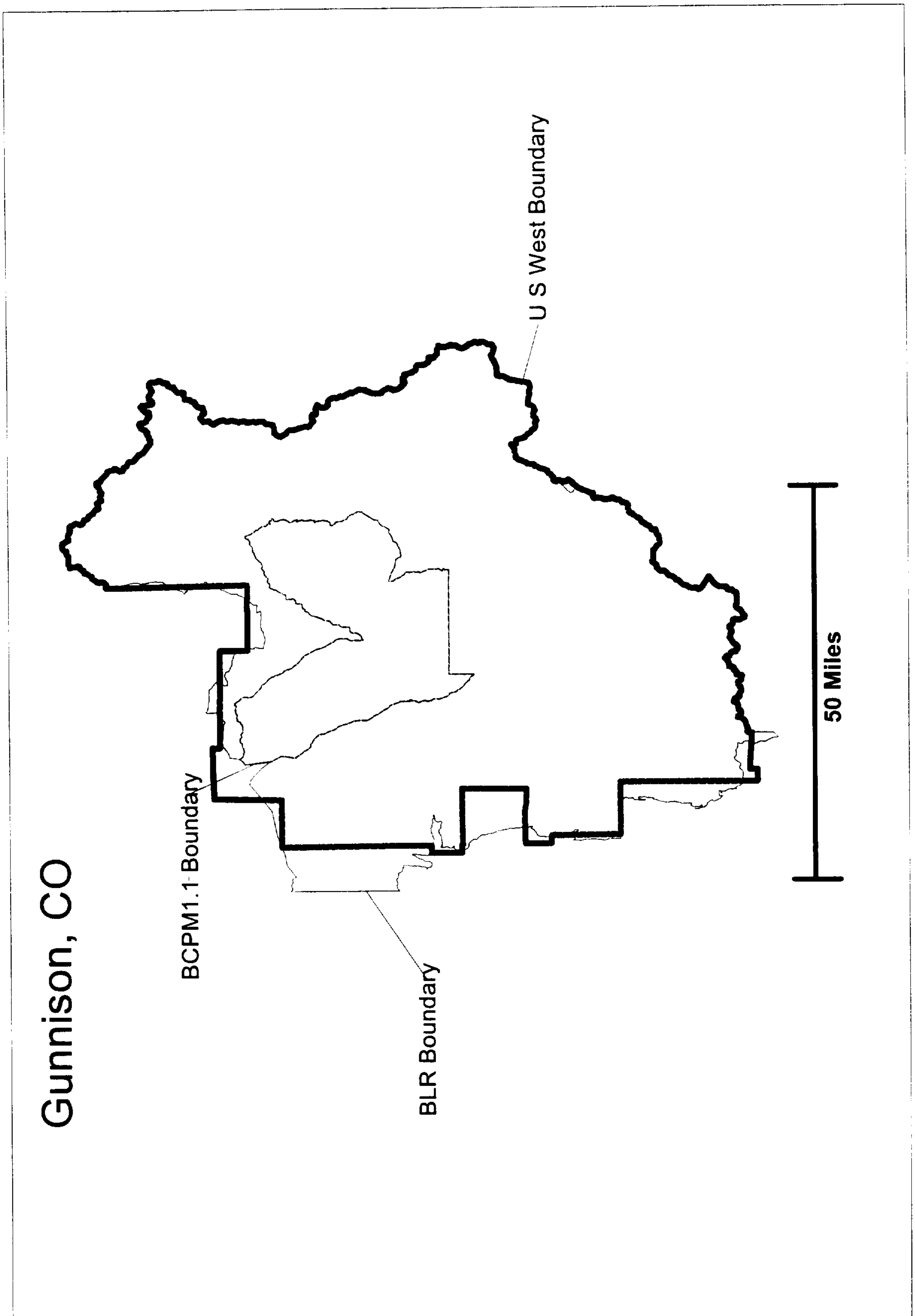
Attachment 1



## CERTIFICATE OF SERVICE

I do hereby certify that I have this 26th day of November, 1997, served all parties to this action with a copy of the foregoing **COMMENTS OF BELLSOUTH CORPORATION, BELLSOUTH TELECOMMUNICATIONS, INC., U S WEST, INC., AND SPRINT LOCAL TELEPHONE COMPANIES IN RESPONSE TO PUBLIC NOTICE REQUESTING COMMENTS ON THE HYBRID COST PROXY MODEL** by placing a true and correct copy of same in the United States Mail, postage prepaid, addressed to the parties listed on the attached service list.

S. C. Shackelford

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